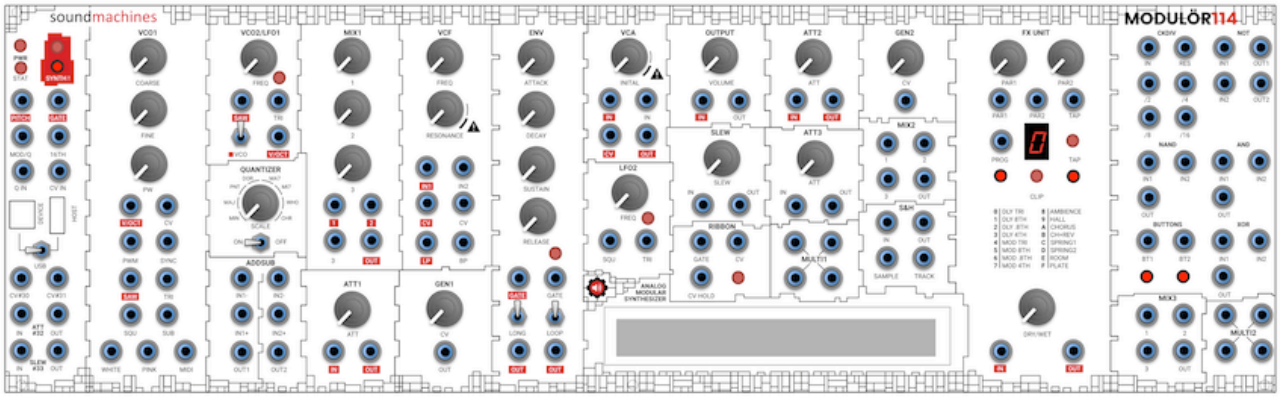
soundmachines

MODULÖR114

Analog Modular Synthesizer



OWNER'S MANUAL

Version 1.0 September 2016

progettato e costruito in Italia

TABLE OF CONTENTS

be sure to check our website's MODULÖR114 page for the last version of this manual!

www.sound-machines.it/product/modulor114

INTRODUCTION

During the last 20 years, after a long hyatus, the modular synthesizer resurfaced in the electronic musical instruments market, and slowly, but steadily, gained attention from musicians and market operators. Few companies and a handful of selected shops around the world carried on this operation, silently and passionately, focusing on a new format inspired by an industrial standard: the Eurorack.

Now, twenty years after the first eurorack modules from Dieter Doepfer hit the market, we have a plethora of brands and shops that build up one of the most eterogenous, interesting and infectious environment ever!

As much as 200 brands, from the industry's big names to the smallest of the one-man-shops, are populating a blooming community and more or less every week a new module is announced! From the simplest of the utility to the complex analog and digital multi-role modules, the choices are pretty much infinite and, for a beginner, a little bit overwhelming..

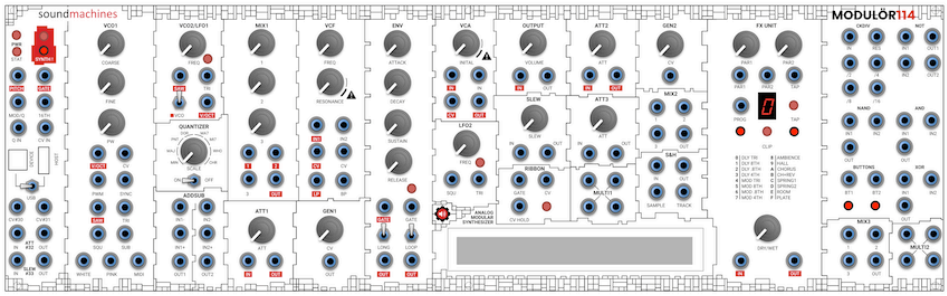
Many people starts building their systems (that does not only involves choosing the modules but also cases, power supplies and accessories..) and come to a stop when they realize that the road to the eurorack heaven is steep and with no refreshment in sight.

You need a little background in synthesis, a few concepts regarding signals, voltages and impedances, and while really fun to pursue and achieve, this can take some time and effort.

We choose to design a dual-role machine... A product that can either be your first analog modular synthesizer and the base of a growing system, one machine that contains a beginner's signal path and a 30 module beast, that can generate all the classical analog tones but also a plethora of overmodulated, space-bound and rhythmically inspiring sounds.

All of this without having to care for a case, a power supply, external fx units and midi/cv interfaces. Everything is included, at hand, ready to be played and, if you choose the dark path of modulars, ready to be the center of your ever-evolving eurorack system. You can even unmount the panel from the case and screw the synthesizer to an empty 84hp row on your case!

Finally, here is your MODULÖR114, a complete, all-in-one, eurorack analog modular synthesizer!



BOX CONTENT

- MODULÖR114
- OWNER'S MANUAL
- USB CABLE
- 10 PATCH CABLES
- USB LAMP

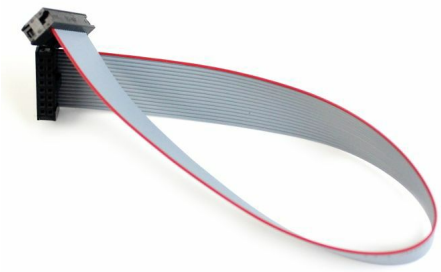
CARE AND FEEDING

The MODULÖR114's main source of power is the USB (Type B USB device port) socket on the front panel. The MODULÖR114 draws just 300mA from 5V and every PC or USB phone charger will do the job! Just connect the supplied cable to your PC/MAC and you can start playing and patching.

Please be aware that a certain amount of noise could come in through the USB port (switching noise of less than ideal power supplies etc...). Altough normally this is perfectly acceptable, to minimize this you should avoid no-brand or extremely cheap adapters. You can also power the MODULÖR114 with a USB power pack to have hours of fun without a wall plug at hand!

The MODULÖR114 can also be powered with a 12Vdc adapter. It is strongly advised that, to use the included USB LAMP, you power the unit with a 12Vdc 1A power supply (5,5/2,2mm barrel jack, central positive), as the nominal current that a PC USB port will supply is 500mA and the sum of the MODULÖR114 and the lamp consumption surpasses this!!!! PLEASE DO NOT ATTEMPT TO RECHARGE YOUR PORTABLE DEVICES WITH THE USB HOST PORT.

Finally, you can power the unmounted MODULÖR114 front panel with the standard eurorack 16pin ribbon cable (see section 9).

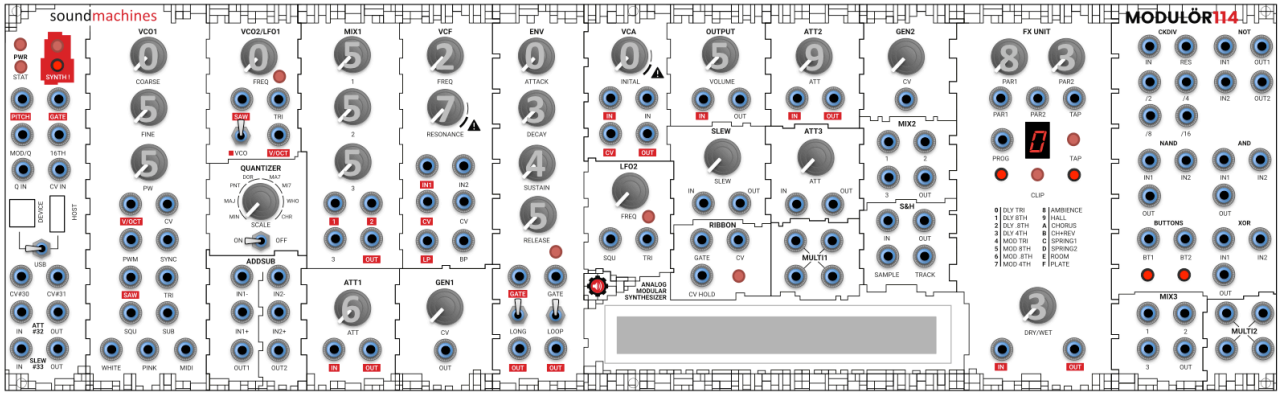


QUICKSTART:

The MODULÖR114 synthesizer, albeit its imposing appearance, can be played right out of the box without even connecting one single patch cable!

It's easy as 1,2,3 (and, well, 4,5,6,7 too)!!!!

1. Make coffee.
2. Unbox the MODULÖR114.
3. Power it up either with your PC (through the supplied USB cable), "PWR" led will lit.
4. Set the MODULÖR114 in SYNTH! mode, press the key for more than 1sec. SYNTH! led will lit.
5. Set the USB switch to HOST and insert a USB keyboard controller (the unit reacts to MIDI channel #1), "STAT" led will go BLUE.
6. Set the controls as indicated below (0-10 convention):
7. Play and start modify whatever you want!!!!



The "SYNTH !" patch of the MODULÖR114 implements a basic but complete monosynth architecture, without having the need to connect the main modules with patch cords.

Basically the MODULÖR114 becomes two oscillators (the SAW waveforms are used) that gets mixed in the MIX1 modules and then reaches the VCF (lowpass) and the VCA. The ENV ADSR module, excited by the GATE signal, modulates either the VCF cutoff frequency and the VCA amplitude by means of the two attenuators, respectively ATT1 to the VCF and ATT2 to the VCA.

The timbre that exits the VCA is then fed to the input of the effect unit and then to the OUTPUT module that can also handle headphones ! Please, be aware that the VCF in high resonance setting can self oscillate and put out a higher volume than normal, so when you are venturing into this kind of operations, lower the volume to save your ears/speakers and raise it again when the setting is done.

This will be necessary only at the beginning, in few minutes of knob-twisting you will know where the soft spots (or the harsh ones!) are.

A small word about tuning. As with the most part of fully analog modular Voltage Controlled Oscillators, the tuning is (in first approximation, more on this later..) made by hand between the two oscillators and/or the oscillators and an external source (other instruments, a guitar, etc..). Remember only that the two MODULÖR114 VCOs starts from 30Hz that is a little bit lower than a C1 note (32.703Hz) and you can fine tune this on the VCO1 pretty easily with the FINE knob. If you want unison (with maybe a little detune, you can then mix in the VCO2 and carefuly adjust the TUNE knob. It's not immediate, as the knob have a pretty large range of frequency, but hearing the beating between the two VCOs and make this beating disappear is really easy to do by ear! Having said that, you will probably end up detuning the VCOs to obtain that analog distinctive evolving, organic, someone call it 'fat', sound! If you think 30Hz is not low enough, try the SUB output that will make you experiment the lowness (??!?) of 15Hz.

BLOCK DIAGRAM

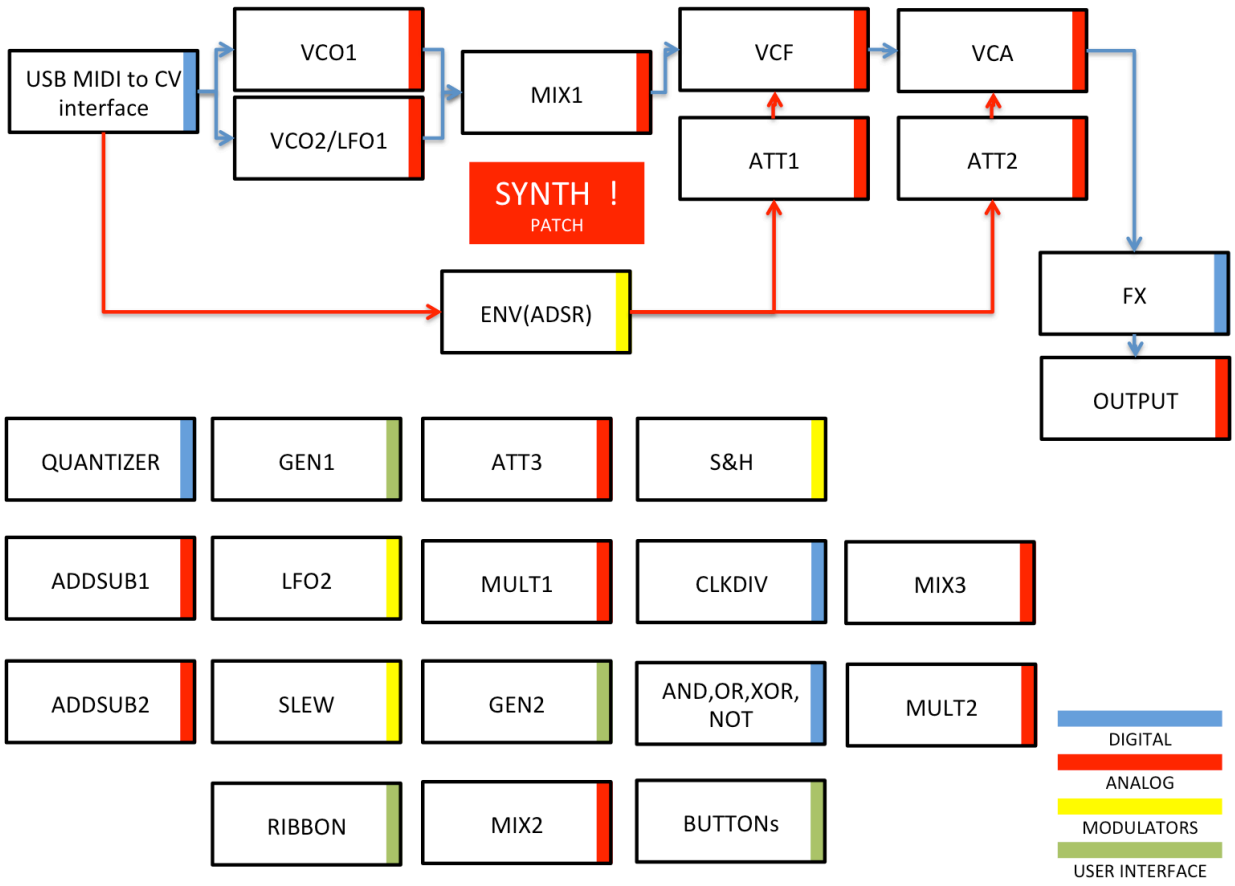
The MODULÖR114 synthesizer is composed by a multitude of independent synth modules that the user can either patch at the touch of a (SYNTH !) button to implement the classic mono-synth architecture (VCOs, VCF, VCA, plus ADSR and FX) or freely combine to generate complex soundscapes, evolving drones and multi timbral situations.

The synth is eurorack compatible and, apart from patching the modules on board, it can be interfaced to any existent eurorack system, modules and accessories like sequencers and keyboards.

The choice of modules, as you can see, is wide and non-trivial. We treated ourselves to many unusual module (especially in entry-level modular synths) like a ribbon controller, a quantizer, a well formed digital clock and logic gates section and, finally, a great sounding fx unit. A comprehensive MIDI to CV interface (either device and host) is included, implementing a complete single unit system.

We obviously included the building blocks needed by every synthesizer, like great sounding VCOs, an aggressive resonant filter, a very fast envelope, and a good linear VCA. Many more things awaits you on the MODULÖR114 and this section will show them altogether.

- USB MIDI to CV: device and host MIDI UDB interface with pitch, clk, modwheel and 4CV
- VCO1: saw core VCO with simultaneous wavefrom outputs, sync, pwm and sub-oscillator
- VCO2/LFO1: saw core VCO with saw and triangle out. Doubles as VCLFO
- QUANTIZER: 4 octave output chromatic and scale quantizer
- ADDSUB x 2: adder/subtractor with saturation devices
- MIXERS x 3: pot levels and fixed cv and audio mixers
- ATTENUATORS x 3: standard attenuators
- GENERATORS x 2: manual CV sources
- VCF: 12dB/oct resonant lowpass and bandpass
- VCA: linear VCA
- LFO2: triangle and square output LFO
- ENVELOPE: ADSR envelope generator with gated loop and two time constants
- RIBBON: 10cm ribbon controller with gate/cv out and cv hold
- S&H: sample and hold with track input
- FX: 24bits high-quality digital effect with parameters cv control and tap-tempo
- CLKDIV: clock divider with 4 outputs and reset input
- LOGIC GATES: and, nand, not and xor
- SLEW: lag processor
- BUTTONS x 2: manual trigger/gate button
- MULTI x 2: passive multiples

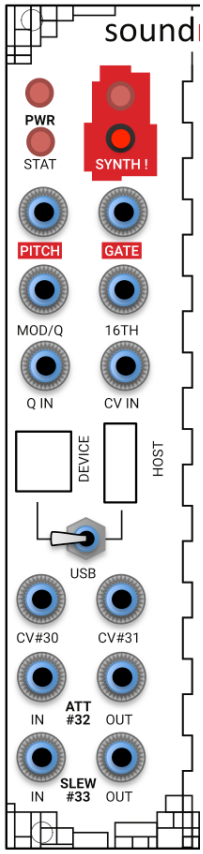


block diagram of the MODULOR114 with the 'SYNTH!' pre-patched architecture

MODULES DESCRIPTION

The MODULÖR114 includes 30 different modules, from very simple to quite complex. In this chapter we will describe each of them and give some hints on simple and complex, or alternative, usage. We start from the basic building blocks and then proceed to the less common one.

- **MIDI**



The MIDI section includes three subsections, the STATUS indicators (on top of the module), the USB MIDI/CV interface, and the MIDI/ANALOG functions jack at the bottom.

Starting from the top you have the first, fundamental, indicator of the MODULÖR114, the "PWR" led. This will lit when the unit is correctly powered by one of the possible sources (USB, 12Vdc jack, Eurorack ribbon).

The "STAT" indicator houses leds of different colours that indicates several functions:

- BLUE: the MIDI HOST function is active (i.e. a USB keyboard is connected)
- GREEN: MIDI data from the USB DEVICE interface are coming in

The "SYNTH !" button and led are responsible of bringing up the pre-patched monosynth architecture at the touch of a button. By pressing for more than one second the SYNTH button, the MODULÖR114 instantiates the internal connection of some of the modules (the inverted RED labels on many modules indicates which patch points are used!).

USB MIDI to CV interface: The MODULÖR114 includes a dual role USB midi interface. It is capable of connecting either to PC and MAC DAW (or capable iOS and Android devices) as a 'DEVICE' (USB jargon) or directly to a USB MIDI keyboard (or control surface) impersonating a USB 'HOST'. This second possibility opens the way to computer-less modular synth setups especially interesting for live activity! You can change the connection at the flick of a switch, just by pointing it at the right connector!

There is a current limiter on the "DEVICE" port to protect it from highest loads.

PLEASE DO NOT TRY TO RECHARGE YOUR SMARTPHONE WITH THE USB PORT

The MIDI capabilities are exactly the same between the two connection modes.

The MIDI implementation is pretty straightforward. The MODULÖR114 responds to MIDI messages on channel #1.

The incoming MIDI messages are parsed and, depending on their content, one of the following actions are taken:

- NOTE ONs and NOTE OFFs: The MODULOR plays 5 octaves (5V) between C1 and C6. You can obviously change the output frequency of the VCOs by changing their tuning. The note played is the highest active.
- PITCH BEND: The pitch bend is directly applied to the outgoing PITCH CV, with 4 semitones range (+/- 2).

- MODULATION WHEEL: the MOD WHEEL CC is applied (when the quantizer is not active) to the MOD/Q output, with a voltage between 0 and 5V.
- MIDI CLOCK: if available, the MIDI clock (/6) is presented as a 16th clock to the "16TH" output. This output is a 5V rectangular wave.

It is advised, as in any other MIDI equipment, to avoid sending unuseful data on the channel (like CCs etc..) as the traffic on the MIDI line could lead to glitches and stuck notes. To avoid a permanent condition of a (ever possible) stuck note, we put an **hidden 'PANIC' function** that is activated by pressing the two BUTTONS (far right) together for one second.

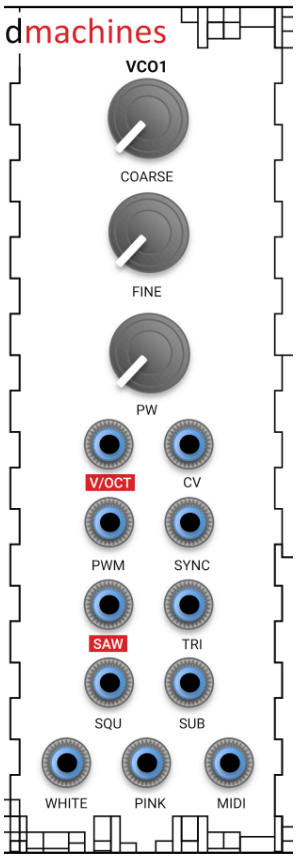
The MIDI features extends to the lower part of this module with a very useful MIDI CC to analog functions mapping:

- CV#30: Control Voltage output (0-5V) based on the value of CC#30
- CV#31: Control Voltage output (0-5V) based on the value of CC#31
- CV#32: Attenuator block based on the value of CC#32 (**MAX VOLTAGE 5V!!!!**)
- CV#33: Slew block basd on the value of CC#33 (**MAX VOLTAGE 5V!!!!**)

Each of those functions works on an 8bit resolution, so 256 linear steps are implemented.

This section opens up a great deal of possibilities to automate and sequence many analog functions. As examples, you can patch the CV# blocks to: VCF cutoff or the FX cv inputs and animate the timbre along the patch. You can also attenuate an oscillator (remember that in the MODULOR many signals are DC coupled) or, trhough the ADDSUB block shape the waveform of one of the VCOs using the saturation features of that block. With the CV#33 (slew block) you can, instead, make that per-step 'slide' sound typical of a very famous box of the past!

- **VCO1**



The VCO (Voltage Controlled Oscillator) is the pulsating heart of every synthesizer. Is the primary source of sound and, in the end, a good part of the character of a machine. We designed and implemented a traditional full-function saw core VCO in our synth to give the musician a good starting point in terms of timbre and flexibility.

The VCO1 is a complete analog oscillator that outputs SAW, TRIangular and SQUare waves, along with a SUB oscillator, two different noise flavours and a MIDI locked square wave.

As with any modular analog oscillator, the VCO1 is a free-tuning module, you don't have a connection with the frequency of the standard 'chromatic' scale until you dial it with another source or against a tuner (for example).

The VCO are calibrated to track at least 6/7 octaves in the musical range. "As is" (you probably noticed the small holes near the top of the two VCOa) the VCOs starts at circa 30Hz when there is no voltage at the V/OCT and CV inputs (just V/OCT for VCO2). We will describe the calibration procedure in a separate document in the future. It can be useful, for example, to LOWER the base frequency and go into few Hz...

The pitch input of the VCO is the V/OCT jack. This input is directly connected to the exponential converter, *[NERD ALERT ON]* the (in)famous circuit that makes us happy (because with few volts at the input you can span several octaves..) and makes us spin in hell because of the need to counter the effect of temperature over the tuning with more components (the famous TEMPCO) *[NERD ALERT OFF]*.

You can connect to this input any voltage source but you will probably end up using some kind of tempered output, such as the MIDI/CV "PITCH" output or the QUANTIZER output "MOD/Q" when is active. One basic but very useful effect, the so called 'portamento' is achieved inserting a SLEW between the PITCH output and the V/OCT input of the VCO. This way you obtain that note "sliding" tone that is a must-have in every synthesizer.

Real fun arise, on the contrary, when you modulate this input with less than ideal outputs like a random voltage (WHITE noise, maybe smoothed with the SLEW) or the output of the VCO2 for the exponential FM effect. Experiment with connections, attenuations and you will find many interesting and unusual tones.

The CV input, on the other hand, is a differently scaled frequency control input that you can use to 'sum' to your basic frequency information (the signal that is injected into the V/OCT jack) another modulation source (more or less attenuated) to implement, for example, vibrato or more deep frequency modulation effects.

The VCO1 have another couple of inputs that are fundamental for reaching a complex tone at his outputs and/or simulate the basis of stringed ensembles etc..

The PWM input acts (along with the PWM pot) on the ratio between the high and low states of the 5V rectangular wave present at the SQU output . By changing the PWM you can hear a very rich effect due

to the massive change in harmonic content of the signal. This was one of the first 'effect' (due to his very simple circuitry) that was used by musical instruments manufacturer to simulate, for example, string ensembles and slowly evolving pad textures... Connecting the LFO to the input shows this capability.

Remember that, as with any other module with either manual and external voltage modulations, the amount of those settings get summed. If, for example, the PWM pot is at full scale (full CW), the jack input has no possibility to modify anything, as the internal value is already at full scale!

The other input, capable of devastating effects on the output waveforms, is the SYNC. This input, invasively, resets the status of the internal oscillator (the SAW core) and put the VCO1 as a SLAVE to another VCO. When configured correctly, the synthesizer will produce the classic ripping lead sound, rich in harmonics and very dynamic. The best waveform for hearing the effect is the SQU.

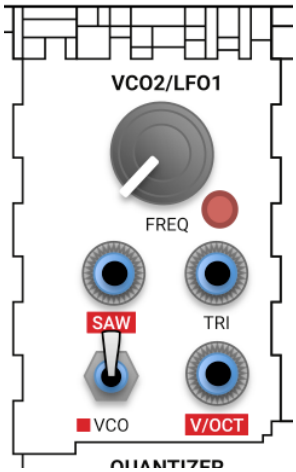
A brief explanation of a SYNC patch follows: Use the output of a decaying envelope to modulate the frequency of the VCO1 (just be sure to put an attenuator between the ENV and the CV input). The SYNC input (that become the REAL frequency input) sould be connected the the output of MASTER VCO (VCO2, in this case) SAW output (the SYNC input needs a steep waveform to reset consistently). Now, you play the VCO2 with the MIDI to CV and the output of the ENV sweeps the frequency of the VCO1. The secret is to set the starting frequency of VCO1 and the attenuation of the ENV OUT signal. Ideally you should have a starting frequency of VCO1 that is much lower than the VCO2 frequency (your "melodic line" tone) and a sweep amount (calibrated with the attenuator) that suits you expectation of the effect. Controls are critic in this patch! Be patient!

Finally, we will describe the last row of jacks: the two noises are the classic WHITE noise and PINK noise circuits that can be used in many different ways, from the simulation of wind, flute attacks, thunders, to the usage as a caothic source for the Sample and Hold circuit to achieve the classic robot sounds or, more finely, add a random touch of cutoff frequency to any new note you play...

The last, but very important output, marked "MIDI" is infact a third oscillator, this time a DCO (the timing is realized in hardware from the same chip that does the MIDI/CV and it sports a very simple, but good sounding, perfect square wave.

This output, apart for implementing massive three-oscillator lead, basses and drones, is really good for tuning purposes!!! Just hit a note and tune the VCO1 and VCO2 against this until it sounds right (you hear no more beatings).

- **VCO2/LFO1**

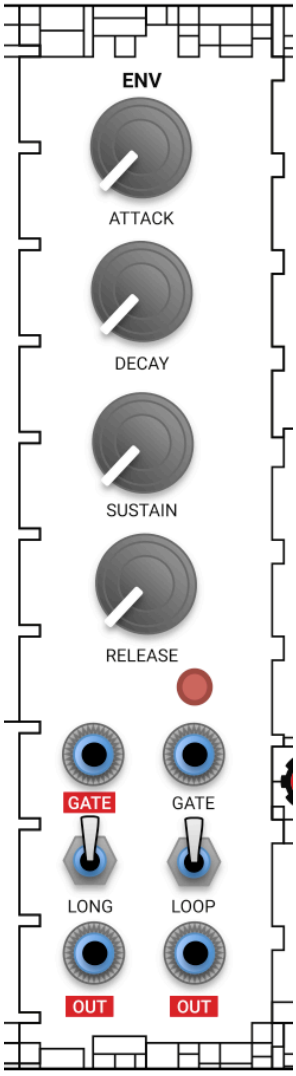


The second VCO of the machine shares the same identical architecture with the VCO1. It is a saw core circuit with just two waveforms for output (TRI and SAW) and a single V/OCT input. There is also a physical switch that allows you to change between a VCO and an LFO by lowering the frequency by more or less two octaves.

Without sharing any more info on the VCO functionalities (confront the previous chapter) we only give the information about the LFO range of this module.

The LFO frequency, valid with both the waveform outputs goes as low as 0.4Hz. Obviously the LFO tracks the V/OCT input, implementing a classic Voltage Controlled Low Frequency Oscillator (VCLFO)

- **ENV**



The envelope generator (ENV), also known as ADSR , is the main modulation device that every synthesizer have in its toolbox. Sometimes there are more than one, we will see in the other chapter how to transform other modules in an emulation (with limitations!) of an envelope generator.

We implemented a standard 4 stage envelope generator with the added bonus of a LONG and LOOP switches.

The envelope generator is used to shape dynamically the sound by applying this modulation each time a high level GATE signal is received. The envelope generator is a simple state machine that follows a series of steps with different timings and intensities depending on the control knobs setting.

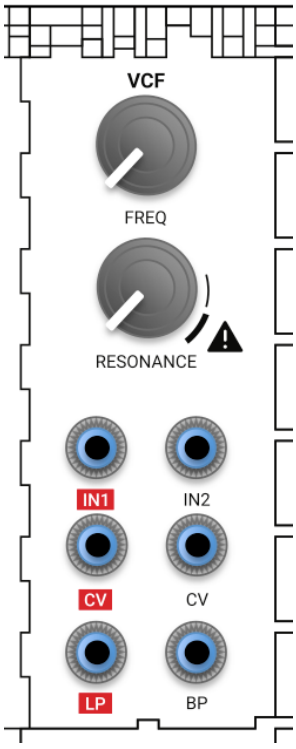
The first usage of an envelope generator is to apply its output to a VCA, adding a dynamic shape to the output volume. Following the classic example of two very different instruments, the piano and the flute, we can explain better what's going on. When the key of the keyboard is pressed the envelope reaches very quickly its maximum (the hammer hits the string) and then quickly diminish the volume (the natural decay of string's vibrations) until the finger is raised from the keyboard (GATE goes to zero!) and the sounds ceases. The setting for a classic piano volume envelope (hammered string) will be a zero-attack, a very long decay, zero sustain and zero release. On the contrary, a flute envelope (an instruments that can sustain the sound until the player has air in his lungs) have a small attack phase, a zero decay, a full sustain and a zero release. Try to experiment with those values to reach your target. The envelope has two time constants (the LONG switch) and, if you want you can activate the longest one, loosing a bit of speed on the attack. You can also LOOP the envelope implementing some kind of GATED LFO by playing with the values. In LOOP mode, as long as the SUSTAIN knob is at zero, and the GATE is high, the module will CYCLE through its ATTACK and DECAY times up and down, implementing an

(exponential) variable shape waveform output.

Another fundamental usage of the ENV module is the modulation of the filter cutoff frequency, that gives that 'taawww' effect used on many basslines. With the use of one of the ADDSUB modules you can also invert the output and obtain a different and interesting sonic effect.

- **VCF**

Probably the most important circuit built into any synthesizer (with respect to the sound character of the product) the Voltage Controlled Filter is the module that shapes the waveforms coming from the oscillator subracting (or adding!) harmonics depending on the type, the cutoff frequency and the resonance settings. Probably each synthetic sounds that we hear (analogue or digital) are affected by some kind of filtering to achieve their presence. The VCF shapes dynamically the incoming signal by applying a changing control voltage to the CV input.

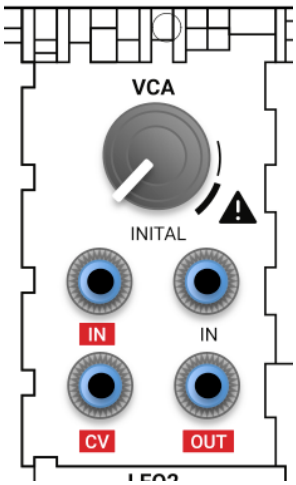


Our filter is a 12dB/octave resonant Low Pass and Band Pass filter based on the OTA technology. *[NERD ALERT ON]* OTAs are an interesting variety of operational amplifiers (the building bolck of any analog circuitry) that can change their 'series resistance' by injecting more or less current into a control pin. I simplified enormously the argument but is more than enough for now... *[NERD ALERT OFF]*

The OTAs in the circuit implements the 'poles' of the filter and a feedback path is added to implement the resonance circuit. The resonance concept could be thought as an enhanchement of the "volume" of the frequencies in the vicinity of the cutoff frequency. The more the resonance the more harmonics are 'created' by the augmented dynamic response to the input signal. At a certain point, rising the resonance in the danger zone, the filter starts oscillating on his own, without even a signal injected. We left the possibility to go into wild and distorted self oscillations because we consider this a potential source for sounds. Keep in mind that on most fixed architecture synth this is avoided, to keep the user in a comfort zone that we positively hate.

Try for yourself the two flavours of filters, play with the knobs and apply modulations as you wish, this filter have a great character, including harsh oscillation-limit tones and screams like a flock of banshees.

- **VCA**



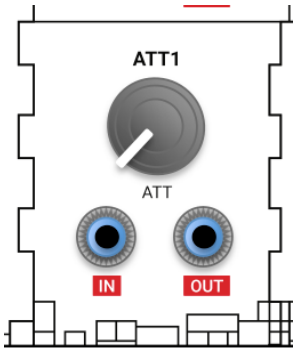
The Voltage Controlled Amplifier is another fundamental module in a synthesizer. His raison d'etre is to operate the volume shaping on the outgoing signal. In our case the VCA is AC coupled and qualifies itself as a LINEAR AUDIO VCA. You cannot input CV signals (or.... you can but with nothing will appear at the output!!). To simulate this we have other modules on board!

The function of the audio VCA is one and this is reflected in the simplicity of the controls. INITIAL sets the amount of volume that the circuit apply to the input signal when there is no CV signal. This is useful to play drones and to offset the CV signal to go into soft saturation when is needed.

You can output and sum two audio signal at its inputs and then at the OUT jack, have the processed signal.

That's it. We implemented a soft saturation for high output leves and you can achieve this by having a full dynamic at the CV input and rotating the INITIAL KNOB until you hear the effect. Use high volumes of signal at the input!

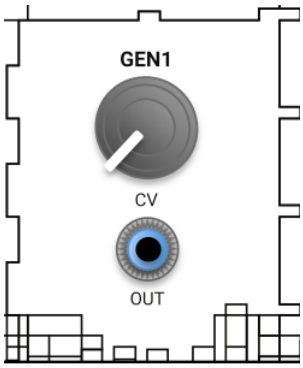
- **ATT1,ATT2,ATT3**



An attenuator is a simple module that reduces the signal at the IN jack before sending it to the OUT. This humble module is absolutely useful and having few of those at hand allows you to create a meaningful patch and 'drive' the patch during the performance or the studio recording!

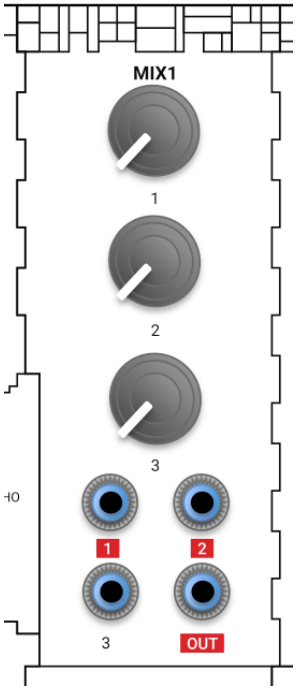
The ATT1, ATT2 and ATT3 on the MODULÖR114 are passive attenuators, basically simple voltage dividers implemented with a pot. Albeit simple you can attenuate, linearly, any signal, CV or Audio.

- **GEN1,GEN2**



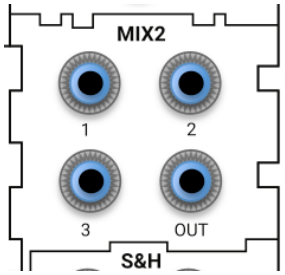
The GEN1 and GEN2 blocks are two control voltage generators. With those two utility blocks you can generate a voltage that goes from 0V to 5V by rotating the knob. One of the possible uses is to generate offsets for anything that goes into the ADDSUB blocks or the MIXERS or, for example, use the CV output as the input for the S&H module.

- **MIX1**



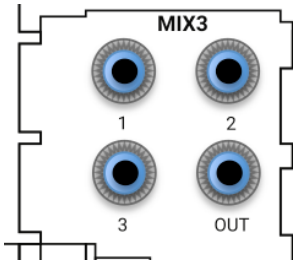
MIX1 is the main mixer of the MODULÖR114 and it is strategically placed near the oscillators. Its main purpose is to mix the output waveforms of the VCOs and send the signal to the VCF. But this is only the most straightforward thing that you can do. As with any other mixers on board, the MIX1 is DC-coupled. This means that you can also attenuate and then sum control voltages or mix the two type of signals!

- **MIX2**



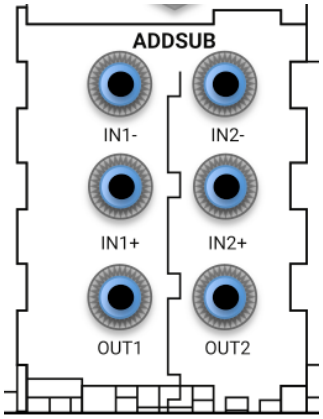
MIX2 is identical to MIX1 except for the lack of input attenuators. The OUT is the sum of the three inputs. You can use this MIXER, for example, to add voltage to your pitch information to transpose a sequence, to mix an external instrument with the internal sounds etc.. etc..

- **MIX3**



MIX3, is another DC coupled mixer but with an interesting twist. Its inputs are attenuated 1/3. This could be useful to sum high level CV and Audio signal and be sure that the resulting dynamics will be comparable with that of the inputs.

- **ADDSUB**

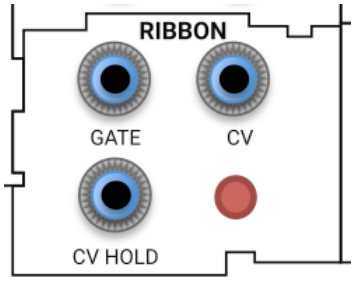


Despite its simplicity, ADDSUB is one of the most useful utilities on the MODULÖR114. We put two identical blocks of what is a 'saturating adder/subtractor'. Basically, the ADDSUB block subtracts IN- from IN+ and everything that results from this operation is kept within a 0-5 volts range.

So what? Well, with this block you can do the following: standard mixer, waveshaper, pseudo-VCA and all the arithmetic stuff that you can do with a subtraction!

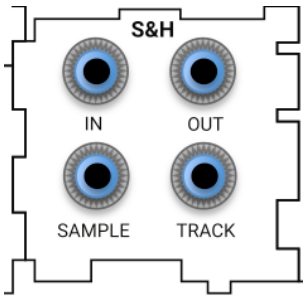
Remember: V-OUT = IN+ - IN- !!!!!!!!!!!!

- **RIBBON**



Surely enough you noticed the ribbon controller on the frontplate of the MODULÖR114. We really wanted to put on the machine a method to play it without having anything else at your disposal, just the MODULÖR114, some patch cables and headphones! The ribbon controller on the product is a resistive strip that generates a voltage depending on the position of your finger on the strip itself. Voltage rises going from left to right, up to 5V. But we put some extra stuff in this block, namely a GATE output and, apart from the standard CV output that obeys to the description above, a CV HOLD output that keeps the last valid voltage with an internal sample and hold circuit. This is necessary to avoid hearing the pitch going down abruptly in a patch where you use a little release on the amplitude waveform! The output on the CV HOLD jack has a small time constant, necessary to 'lock' the voltage when you raise your finger, so, when you 'press' the strip and start a GATE signal you could hear a little portamento effect. It's not an annoying thing but we had to say it! I won't even tell you (no, really I will) how fun it is to play the MODULÖR114 just with the ribbon and the quantizer!!

- **S&H**

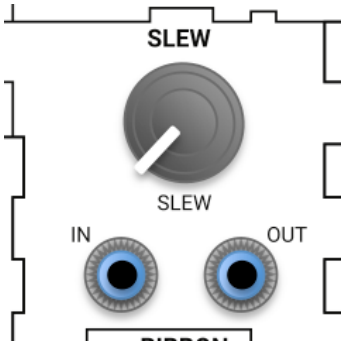


The Sample and Hold block (that also contain the Track and Hold capability) is a fundamental tool in the modular synth toolbox. Many different effects and utilities can be implemented with this module. Basically it does what it says: on the rising edge of the SAMPLE input, an istantanous snapshot of the voltage present at its IN jack is sampled and transferred to the output. Until a new pulse is present on the SAMPLE input, the OUT voltage will be constant. The most immediate usage is to implement the famous 'computer' or 'robot' sound (just put a WHITE or PINK noise) that hurts our ears since the 70s. But, just by putting the output on the filter cutoff, instead of the VCO pitch, starts to get nice results, especially if the clock is rhytmically interesting and somewhat connected with the melodic sequence. Apart from this,

one very interesting use is putting the output through the scale quantizer and be amused at what come out of your now-seemingly-autonomous synth...

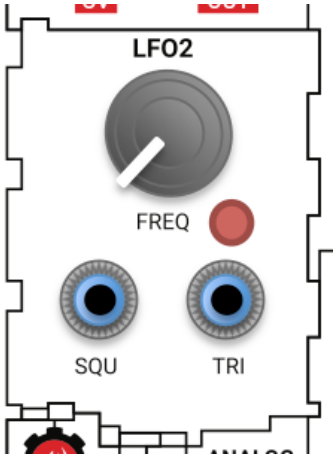
You can also use the TRACK input to bring the IN signal to the OUT jack while the TRACK input is at a high level, and keep (hold) it when is low. Experiment!

- **SLEW**



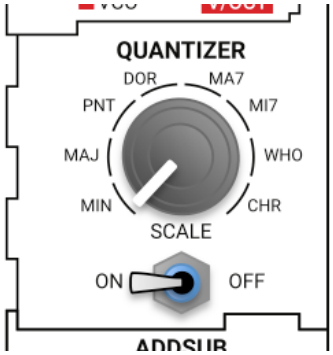
The SLEW module is an active time lag generator. It practically applies a time constant to the input signal before outputting it to the OUT jack. The time constants vary between zero and a little less than one second. Usages for this module are virtually infinite. Just for starters I would put here: portamento, smoothing out the CV coming from the CC# MIDI interface, smoothing the output of the S&H and using it a simple lowpass filter on audio stuff....

- **LFO2**



Another humble but fundamental module, the Low Frequency Oscillator can be used in hundred of ways (modulations, clocks, etc..). Ours will output Triangular and Square waves from 0.3Hz up to 150Hz ! A led is provided to show you the oscillation (related to the triangular output). Patch the output to any input on the synth and hear what you can achieve with a slow oscillating control voltage! To control the amount of the destination effect just pass the LFO through an attenuator!

- **QUANTIZER**



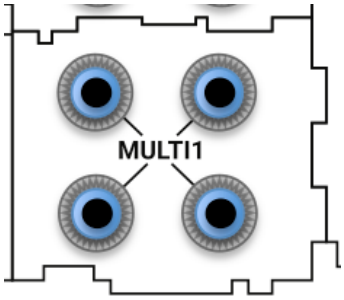
The Quantizer module is a great device to transform your squeals, noise and thumps into something more harmonic and resembling a little music. Just by patching an LFO into an attenuator and then into the quantizer is a lot of fun, but you can use it basically with any voltage source. ANY. Starting from the ribbon controller, that is a pretty obvious choice, up to a potentiometer, to the S&H output and directly to the WHITE noise, you can make everything sound melodically good at the flick of a switch! We choose eight scales to choose from, from the chromatic to the Dorian an Minor Seventh, you have a good choice of moods and environments to play with!

The specifications says that the quantizer works on four octaves (basically

from 0 to 4V at its input) but you can safely input any of the on board output control voltages (that are bound to the 0-5V limits. You will just loose the highest octave.

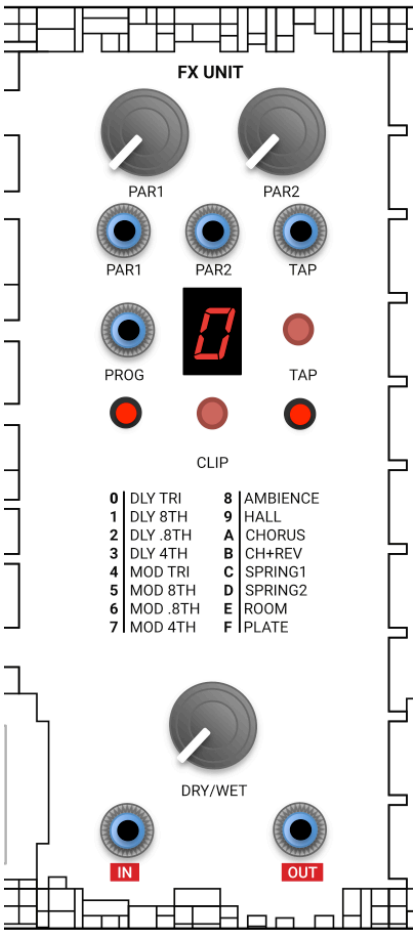
This module, differently from the other, does not have jacks because the jacks resides on the MIDI/CV part of the synth. The input of the quantizer is marked "Q IN" and the output, as said before, is the "MOD/Q" that is shared with the modulation wheel output when the quantizer is not active.

- **MULTI**



The MULTI1 and MULTI2 are identical blocks that you can use to multiply one signal into other identical three. Keep in mind that those are passive multiples. Use it whenever you need to send one source to several destinations! The first example that come to our minds is the doubling of the "PITCH" information coming from the USB interface into the two VCOs "V/OCT" inputs

- **FX UNIT**



The MODULÖR114 has a powerful and good sounding on-board effects unit. This DSP based module has also a great potential to be modulated by external signals, making it alive and perfectly confident on a modular synth!

The FX unit includes delays, reverbs and a chorus, plus some aggregate effects. The usage is really intuitive and really the panel says it all!

Apart from the great sound quality of the effects, the FX UNIT is really good at being modulated and synchronized by the rest of the machine! The two parameters (only one in certain programmes) have knobs and cv inputs to be controlled and there is a tap-tempo button and external clock input.

You can sync your delay to the steps of your sequence but also abuse of those inputs ina a creative way (random pulses, etc..). For the maximum mangling of the input sound weleft the possibility to change even the FX type with an external clock input. Use at your own risk!

DRY/WET potentiometer is the classic control af any 'insert mode' FX units, it sets the ratio between the clean input and the effected output.

Finally, there is a useful 'CLIP' led indicator that will lght up when either the input or the algorythm is overloaded. With the signal path levels of the MODULÖR114, clipping is reached only with the VCF resonance cranked at the maximum!

- **DIGITAL MODULES**

A good batch of creative simple digital blocks is provided on the MODULÖR114. Along with a very useful multi-tap clock divider you also get logic gates (and, nand, xor and inverters) and a couple of manual gate/trigger generators!

Need to create rhythmic pulsations? patch two outputs of the clock divider (driven by an LFO) into the XOR and the resulting gate will exhibit a different rhythmic structure depending on which clock outputs you use! For example, use the different outputs (clk divider, xor, etc..) to drive (maybe through attenuators) the VCF cutoff, the gate, and the fx parameter (maybe through a slew controller). Instant funk.

Want to manually gate a clock into a module? patch the clock itself and the output of one button into an AND gate and you're done! When you press the button the clock is passed at the output.

An XOR gate works very well as a Ring Modulator, not only on square waves. Keep in mind that on the MODULÖR114 the most part of the control and audio signals are around 5V amplitude so you can put analog signal into digital inputs and viceversa!

Want to check this analog/digital cross-contamination? insert the White noise into an attenuator and then into the clock divider. Then use the /16 output to drive the envelope. By raising slowly the attenuator level you will reach a soft spot where randomly spaced gates are generated. This could be a base for dripping / falling drops sounds that, don't need to underline it, works very well with the internal hall reverb!

A MODULAR SYNTHESIS PRIMER

For the people that doesn't come from synthesis or from music production, in the next two pages you will find some basic concepts that will be extremely useful to better understand the following chapter and to enjoy this instrument. Let's start by defining the main characteristics of 'sound'.

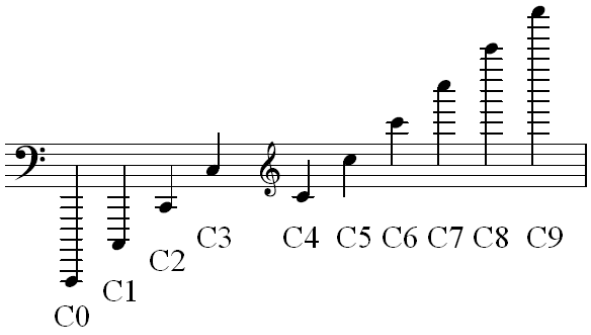
Among the few definition of sound, stands the one that I like more: it's the perceptive phenomenon that our earing subsystem triggers when more or less repetitive variation in the density of the air reach our inner ear organs. This is not the only definition nor the most precise one, but as I said, I like it enough to write it here.

A sound is then characterized by a handful of 'parameters', or qualities. The optimal subset, for what we are going to explain in the following pages (again, far for being complete under a scientific POV) is:

- pitch
- timbre
- loudness

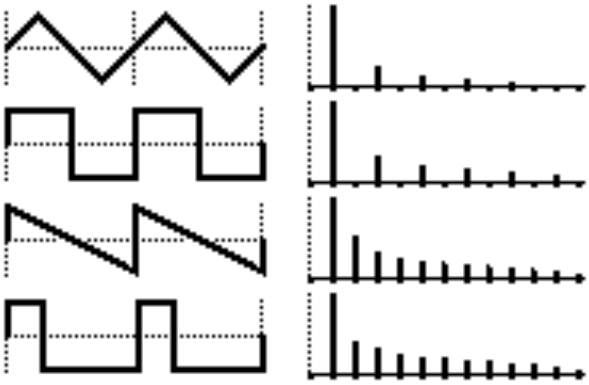
Those are neither static qualities, nor the only ones, but they adds up nicely in this contest. Consider, for starter, that the timbre of a sound could easily modify the pitch until unrecognizable...

So, Pitch is the 'tone' of the sound, what we associate with the concept of 'note'. Not all sounds have a defined pitch, think about the sound of the waves crashing on the beach... In a more harmonic enviroment, such as a techno-trance song, the pitch is responsible, for example, of the bassline that supports the harmonic progression of the piece itself. Do Re Mi Fa Sol La Si, in Italian.



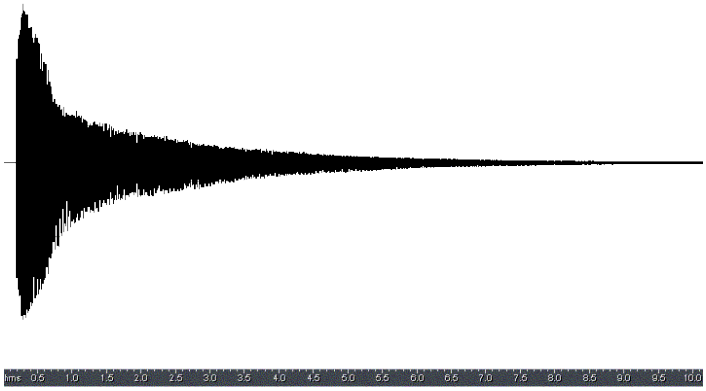
Musical octaves and their pitch

The second 'parameter', the timbre, is the microscopic 'shape' of the sounds. Microscopic on a time scale. Mainly we are talking about the waveform and its dynamic transformations... Think about the timbre of a cello, in contrast to the one of a human soprano, or that of a Strato passing through a fuzz pedal with almost dead batteries... One of the first 'missions' of the electronic musical instruments was the simulation or emulation of traditional musical instruments. Where a triangle wave resemble, with a touch of vibrato (pitch modulation) the voice of a soprano, the narrow pulse rectangular wave could trigger in our brain a certain association with the nasal sound of an oboe. The 'secret' here is the harmonic (or spectral) content of the waveform. Without going into hairy mathematical details I will just leave a reference table below:



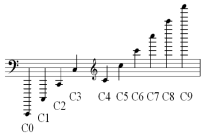
Basic synth waveforms and their harmonic content

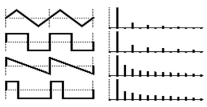
Finally, another very important characteristic of a sound is the evolution of its loudness. The first example is the piano. An almost immediate attack, that the percussion of the hammers provokes on the strings, leave space to a quick 'reduction' of the note's volume in the first few millieconds. At this point, if the player keeps his finger on the key, the note will slowly fade, otherwise the end of the sound will come in few tenths of a second. We like to call the shape of the loudness as the amplitude's envelope.

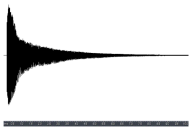


A piano sample amplitude envelope

We briefly defined the characteristics of a 'sound' to be able, in the following chapter, to give an indication of WHAT kind of blocks could be used to implement those in the real world... Now a simple link between those characteristics and their implemented building blocks. First the sound basic qualities:







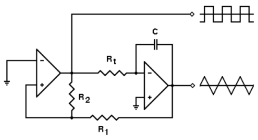
VCO
voltage controlled oscillator

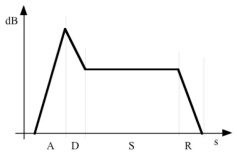
VCO
voltage controlled oscillator

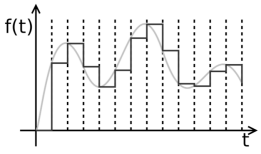
VCF
voltage controlled filter

VCA
voltage controlled amplifier

And then, the modulation sources:







LFO
voltage controlled oscillator

ENV
envelope generator

S&H
sample and hold

Starting from this terminology and structure we can play a little with the concept of subtractive synthesis. The basic concept is that, starting with an (one or more) oscillator, by putting the output tone into a some kind of filter device and then into a controlled amplifier, we can basically synthesize 'every' existing sound, emulating acoustic instruments and creating new sounds. Given that the emulation of acoustic instruments is not our main aim (since many years now, is not anyone's aim :)) we will concentrate on creating sounds and noises that can adapt well with every kind of electronic music production, from drone, to techno, passing through glitch and ambient...

At the end of this manual, the patch sheets will guide you through several examples that will space from the classic monosynth lead sounds to 303-like squelchy basslines, to percussive, drone and self-generating soundscapes...

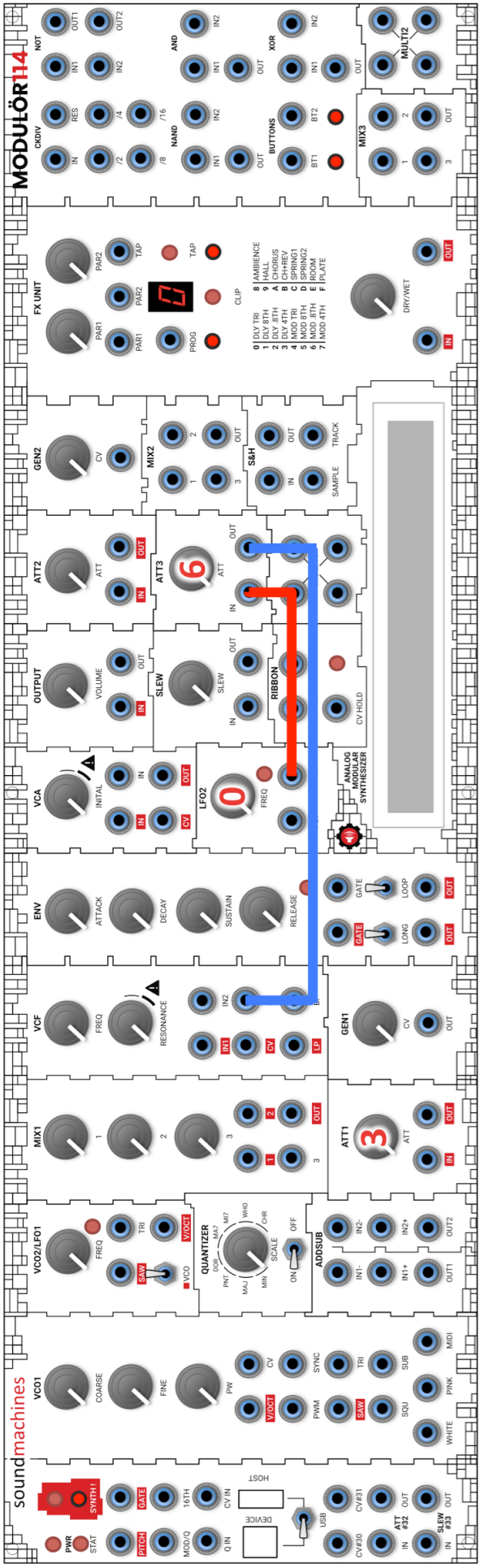
PATCHING EXAMPLES

In the following pages we will stimulate your patching fantasy with some ideas! The first are based on the SYNTH! structure so you don't have to patch the standard voice architecture from the beginning, next more and more articulated patches will be presented!

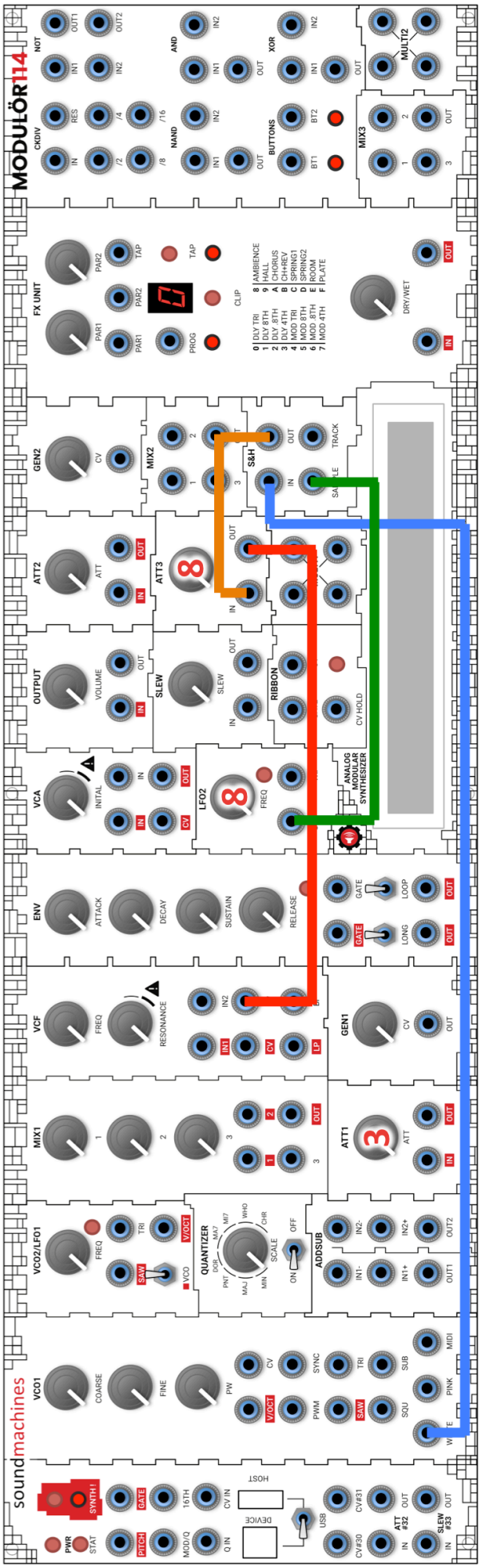
The high resolution, color pictures of the patch sheets are downloadable from the website.

Please check for the last version of this manual on our website!!! This section will be updated frequently. You can also send us your patches and we will populate the online repository and this document!

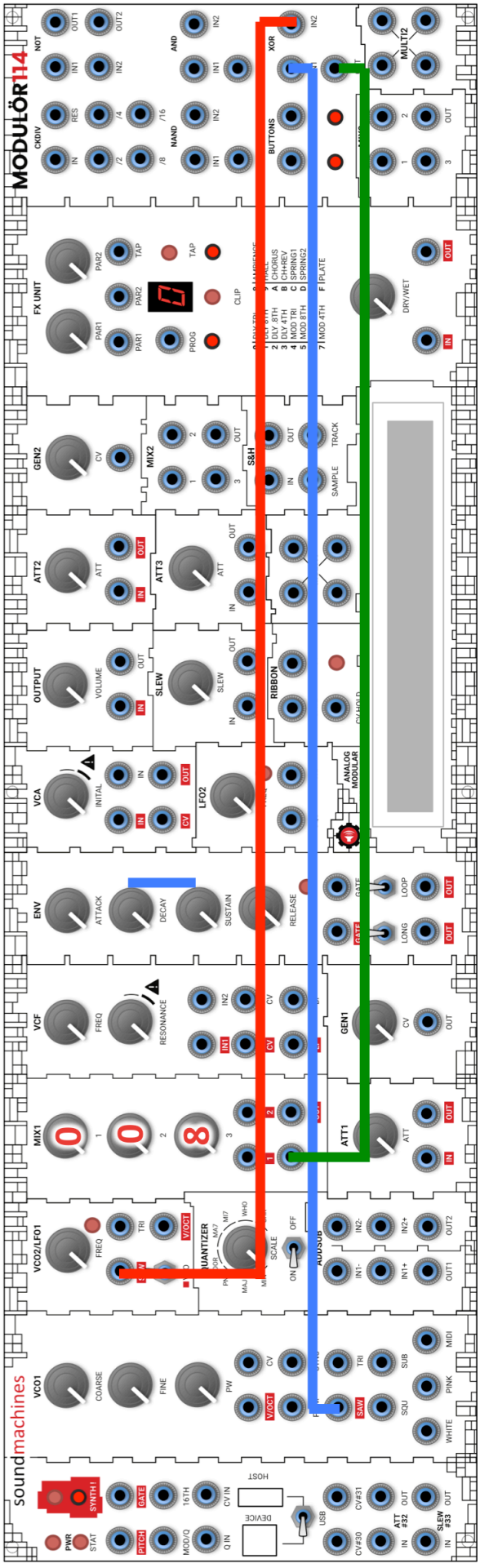
LFO2 VERSUS FILTER (SYNTH! Enabled)



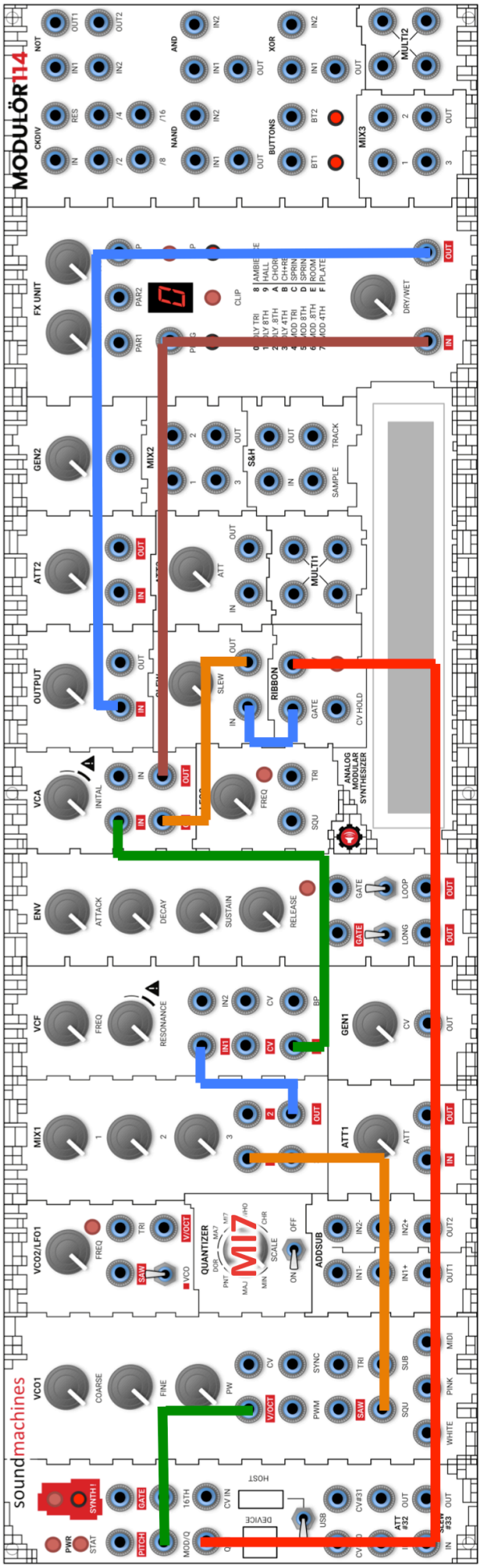
FILTER SAMPLE AND HOLD (SYNTH! Enabled)



RINGMOD (SYNTH! Enabled)



QUANTIZED RIBBON (SYNTH! mode disabled)



INSTALLING THE MODULÖR114 IN A EURORACK SYSTEM

Follow this procedure to correctly install the MODULOR114 in a standard eurorack case with at least 84 free HP. The product will need (excluding the USB power consumption) 250 mA on the +12V power supply rail. If you intend to use an external USB keyboard or control surface connected to the USB HOST port, make sure that extra current is available! Normally simple usb keyboards would not consume much power but to be sure read the specification sheet of the USB keyboard and , when in doubt, contact us.

1. Disconnect patch cables and power supply sources.
2. Unscrew the 6 M3x6 screws on the front panel (you will need an hex screwdriver).
3. Slowly extract the panel (all the electronic is mounted on the panel).
4. You will see the +12Vdc wiring harness that connects the barrel jack to the board.
5. Rotate the panel with the electronics until you see the connector of the wiring.
6. Carefully extract the connector from the board.
7. Connect a 16 way eurorack ribbon cable to the shrouded euro connector (not supplied with the synth) making sure that, with the top of the panel UP, the -12V (red stripe) is on the BOTTOM. The shrouded header normally will protect against false insertions but please, check that -12V goes to the lower of the euro connector pins.
8. Connect the ribbon to the bus bar on your system.
9. Screw the panel to the eurorack case.
10. Turn on the system.
11. Annoy your cat/neighbor/partner or make extraordinary music!

CONTACTS

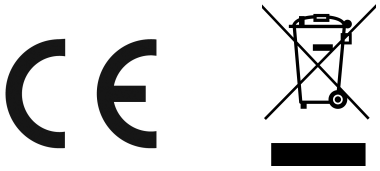
Website: www.sound-machines.it

Email: sales@sound-machines.it

REGULATORY:

Product: soundmachines MODULOR114

Power consumption: 300mA @ 5V



This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

This product is made in Italy by

SPES s.c.p.a.

Via Broganelli 84/A

60044 Fabriano (AN)

Note: all the cited trade marks and registered product names are property of their legal owners.